



## Relationship Between Untreated Early Childhood Caries and Quality of Life among Children in Saudi Arabia

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### Abstract

**Aim:** The present study aims to evaluate the effect of the untreated pulpo-periapical extension of caries (pufa score) on oral health-related quality of life (OHRQoL) of 4-5 years old children using the Early Childhood Oral Health Impact Scale (ECOHIS). **Methods:** A total of 170 children aged 4-5 years with early childhood caries (ECC) and their parent/caregiver seeking dental care at private university dental clinics were included in the present study. The single examiner performed oral examinations of the children using the pufa (pulp, ulceration, fistula, and abscess) index, followed by the self-administration questionnaire of the 13 items in the Early Childhood Oral Health Impact (ECOHIS) scale among the 170 parents/caregivers. **Results:** The results showed an overall pufa score of (1.76±1.86) and ECOHIS-A score (25.08±8.46). An overall pufa score (1.76±1.86) and ECOHIS-A (25.08±8.46) were found in this study. Thenon-Saudi children (2.55±1.47) compared to the Saudi's (1.65±1.89) showed a significantly higher mean pufa score (p=0.005). Similarly, ECOHIS scores differed between non-Saudi (32.64±11.2) and Saudi (23.95±7.39) children (p<0.001). The children aged four years (2.19±2.07) demonstrated a significantly higher mean pufa score than the 5-year-old (1.16±1.29) children (p=0.002). ECOHIS scores showed a significant difference between pufa=0 and pufa>0, (p<0.001). Mean ECOHIS score and pufa score showed a significant positive correlation (r=0.343, p<0.001). **Conclusion:** It was concluded that the untreated early childhood caries with pulpo-periapical extension negatively affected the quality of life of 4-5 years children and their families.

**Keywords:** children, dental caries, ECOHIS, oral health-related quality of life, pufa

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### I. Introduction

Dental caries is a significant oral health issue that affects 35.3 percent of the global population in 2010 [1]. Dental caries has been reported as a widespread disease among children [2]. A high prevalence of dental caries has been reported from Arab countries, including Saudi Arabia [3,4]. A study Al-Malik et al. reported an estimated prevalence of dental caries around 73% [5]. A recent meta-analysis found a mean decayed, missing, filled teeth (dmft) score of 5.38 in the primary dentition [6].

Early Childhood Caries (ECC) refers to all carious lesions in young children's primary dentition between birth and 71 months [7]. ECC's primary effects are pain and infection, resulting in altered eating and sleeping patterns, interfering with the child's growth and development [8-10]. Dental pain caused by untreated

ECC has been shown to harm Quality of Life (QoL), affecting the child's anthropometric and nutritional status, socialization, reduced self-esteem, and learning ability [11]. Therefore, oral health issues may have a detrimental impact on a young child's functional, psychological, and social well-being and the family's overall well-being.

The Early Childhood Oral Health Impact Scale (ECOHIS) was developed to assess oral health-related quality of life in preschool children. This instrument consists of four descriptive domains in the child impact section (child symptoms domain, child function domain, child psychological domain, and child self-image/social interaction domain) and two domains for the family impact section (parent distress domain and family function domain) [12].

An Arabic version of ECOHIS(A-ECOHIS) presented well on all psychometric assessments administered to it. As a result, it is a valid and reliable instrument used in Arabic-speaking preschool caregivers of children aged 2 to 6 years [13]. Recently pufa index was developed to assess the pulpo-periapical extension of untreated dental caries in the primary dentition. The pufa index records the presence of a visible pulp (p), ulceration of the oral mucosa due to root fragments (u), a fistula (f), or abscess (a) in deciduous teeth [14].

There have been several attempts to measure ECC's effect on preschool children using various indices (AlMutairi et al., 2020; Tabassum et al., 2020). However, limited efforts have been made to assess untreated dental caries on oral health-related quality of life among preschool children in Saudi Arabia. Hence the present study aims to evaluate the effect of the untreated pulpo-periapical extension of caries (pufa score) on oral health-related quality of life (OHRQoL) of 4-5 years old children using the Early Childhood Oral Health Impact Scale (ECOHIS).

## II. Materials and methods

### 1. Ethical approval

The study proposal was registered (FRP/2021/343) in the REU research center, and approval was obtained from the center. Informed consent was taken from the accompanied parents (mother/father) to examine the child.

### 2. Study sample and design

A sample of 170 children aged 4 and 5 years and their mother/father/caregiver attending Namuthajiya, AlOlaya, and Munasiya dental campuses of Riyadh Elm University, Riyadh, were selected. This cross-sectional analytical study was performed by employing a convenient sampling methodology.

Child patients aged 4-5 years whose parents could easily speak and write Arabic were included in this study. While children with systemic diseases or taking medication, parents who failed to complete the questionnaires were excluded from the study.

### 3. Questionnaire administration and data collection

The ECOHIS questionnaire comprises 13 items, classified into two sections: impact on children and parents' impact. The initial nine items investigated the impact of the children's oral health, such as eating, sleeping, and talking. The second part, impact on parents, has four questions, two on parents' concerns (2 questions) and two on parents' functions. The questionnaire item response options included "never," "hardly ever," "occasionally," "often," "very often," and "do not know, which received a score of 0 to 5, respectively. Do not know responses were excluded from the final analysis and there were no missing data was found. Overall, the total score of the ECOHIS index ranges from 0 to 52, with a higher total score indicating more oral health problems and less oral health-related quality of life.

The researcher explained the study's purpose to the mother/father/caregivers, and consent to participate in the study was obtained. The parents completed the Arabic version of the Early Childhood Oral Health Impact Scale (ECOHIS) in the clinic's waiting areas.

### 4. Oral examination

A single trained researcher performed all the intraoral examinations of the children to measure the untreated pulpo-periapical extension of caries using pufa index in primary dentition based on criteria of Monse et al. (2010). Kappa statistic was calculated for Intra examiner reliability which was found to be 0.89. All the clinical examination was carried out while the child seated in a dental chair using artificial light. A dental intern was trained to record codes of pufa in a pre-designed proforma.

### 5. Statistical analysis

Descriptive statistics of mean, standard deviation, frequency distribution, and percentages were calculated for the data. Shapiro-Wilk test indicated the non-normal distribution of the data. Hence non-parametric tests of Mann-Whitney U and Spearman's correlation tests were applied to the data. All the analyses were performed using IBM-SPSS software version 25 (Armonk, NY: USA). A value of  $p < 0.05$  was considered significant for all the statistical purposes.

## III. Results

A total of 170 children aged 4-5 years and their mother/father/caregivers participated in this study. Most of the children were Saudi nationals (87.1%), with their father being employed in government services (61.8%), and mothers being a homemaker (68.2%). Most fathers (43.4%) and mothers (42.9%) had a bachelor's education level. Most (29.5%) of the participants had a family income of  $>15000$  SAR. A higher percentage of female children (51.2%) than male children (48.8%) participated in the study. A pufa score of zero was observed among (33.5%), and pufa  $> 0$  was found in (66.5%). More than half of the children were 4 years of age (58.8%), and 41.2% were aged five years. The demographic variables of the study participants are displayed in (Table 1).

**Table 1: Demographic variables of the study sample (n=170)**

| Variables           |                    | n   | %     |
|---------------------|--------------------|-----|-------|
| Nationality         | Saudi              | 148 | 87.1% |
|                     | Non-Saudi          | 22  | 12.9% |
| Father's Occupation | Not working        | 20  | 11.8% |
|                     | Government service | 105 | 61.8% |
|                     | Private service    | 45  | 26.4% |
| Mother's Occupation | Homemaker          | 116 | 68.2% |
|                     | Government service | 35  | 20.6% |
|                     | Private service    | 19  | 11.2% |
| Father's Education  | Primary            | 10  | 5.9%  |
|                     | Intermediate       | 11  | 6.5%  |
|                     | Secondary          | 54  | 31.8% |
|                     | Diploma            | 21  | 12.4% |
|                     | Bachelor           | 74  | 43.4% |
| Mother's Education  | Primary            | 14  | 8.2%  |
|                     | Intermediate       | 18  | 10.6% |
|                     | Secondary          | 53  | 31.2% |
|                     | Diploma            | 12  | 7.1%  |
|                     | Bachelor           | 73  | 42.9% |

|   |             |     |       |
|---|-------------|-----|-------|
| Family income<br>(Saudi Arabian Riyals) | <3000       | 31  | 18.2% |
|   | 3000-6000   | 17  | 10.0% |
|   | 6001--9000  | 22  | 12.9% |
|   | 9001-12000  | 24  | 14.1% |
|   | 12001-15000 | 26  | 15.3% |
|   | > 15000     | 50  | 29.5% |
| Gender of the children                  | Male        | 83  | 48.8% |
|   | Female      | 87  | 51.2% |
| pufa score                              | pufa=0      | 57  | 33.5% |
|   | pufa > 0    | 113 | 66.5% |
| Age of the children                     | Four years  | 100 | 58.8% |
|   | Five years  | 70  | 41.2% |

Untreated dental caries affected smiling (100 %), talking (100%),and sleeping, followed by others in the child impact section. Family impact scales indicated the main effect in taking off from work (98.2%) and upset (94.7%) due to failure to take care of the children followed by other impacts (Table 2).

**Table 2: Distribution of ECOHIS responses for the whole sample (N = 170).**

| Impacts |             | Never |      | Hardly ever/<br>Occasional/often/very often |      | I don't know |      |
|---------|-------------|-------|------|---|------|--------------|------|
|         |             | n     | %    | n   | %    | n            | %    |
|         |             | Child | Pain | 26  | 15.3 | 144          | 84.7 |
|         | Drinking    | 2     | 1.2  | 158   | 92.9 | 0            | 0    |
|         | Eating      | 2     | 1.2  | 152   | 89.4 | 0            | 0    |
|         | Pronouncing | 7     | 4.1  | 159   | 93.5 | 0            | 0    |
|         | Absence     | 4     | 2.4  | 164   | 96.5 | 0            | 0    |
|         | Sleeping    | 3     | 1.8  | 165   | 97.1 | 0            | 0    |
|         | Frustrated  | 2     | 1.2  | 159   | 93.5 | 0            | 0    |
|         | Smiling     | 0     | 0.0  | 170   | 100  | 0            | 0    |
|         | Talking     | 0     | 0.0  | 170   | 100  | 0            | 0    |
| Family  | Upset       | 0     | 0.0  | 161   | 94.7 | 0            | 0    |
|         | Guilty      | 2     | 1.2  | 154   | 90.6 | 0            | 0    |
|         | Work        | 3     | 1.8  | 167   | 98.2 | 0            | 0    |
|         | Financial   | 26    | 15.3 | 144   | 84.7 | 0            | 0    |

Children with untreated dental caries had higher pain (94.7%), difficulty in drinking (100), eating (98.2), pronouncing words (94.7%) compared to the children without untreated dental caries (Table 3).

**Table 3: ECOHIS responses for the subgroups based on the pufa index scores**

| Impacts |          | pufa>0 |     |             |      |      |     | pufa=0 |      |             |      |      |     |
|---------|----------|--------|-----|-------------|------|------|-----|--------|------|-------------|------|------|-----|
|         |          | N      |     | HE/O/Of/VOf |      | I DK |     | N      |      | HE/O/Of/VOf |      | I DK |     |
|         |          | n      | %   | n           | %    | n    | %   | n      | %    | n           | %    | n    | %   |
| Child   | Pain     | 3      | 5.3 | 54          | 94.7 | 0    | 0.0 | 23     | 20.4 | 90          | 79.6 | 0    | 0.0 |
|         | Drinking | 0      | 0.0 | 57          | 100  | 0    | 0.0 | 2      | 1.8  | 101         | 89.4 | 0    | 0.0 |
|         | Eating   | 1      | 1.8 | 56          | 98.2 | 0    | 0.0 | 1      | 0.9  | 96          | 85.0 | 0    | 0.0 |

|        |             |   |     |    |      |   |     |   |     |     |      |   |     |
|--------|-------------|---|-----|----|------|---|-----|---|-----|-----|------|---|-----|
|        | Pronouncing | 1 | 1.8 | 54 | 94.7 | 0 | 0.0 | 6 | 5.3 | 105 | 92.9 | 0 | 0.0 |
|        | Absence     | 2 | 3.5 | 55 | 96.5 | 0 | 0.0 | 2 | 1.8 | 109 | 96.5 | 0 | 0.0 |
|        | Sleeping    | 3 | 5.3 | 54 | 94.7 | 0 | 0.0 | 0 | 0.0 | 111 | 98.2 | 0 | 0.0 |
|        | Frustrated  | 2 | 3.5 | 53 | 93.0 | 0 | 0.0 | 0 | 0.0 | 106 | 93.8 | 0 | 0.0 |
|        | Smiling     | 0 | 0   | 57 | 100  | 0 | 0.0 | 0 | 0.0 | 113 | 100  | 0 | 0.0 |
|        | Talking     | 0 | 0   | 57 | 100  | 0 | 0.0 | 0 | 0   | 113 | 100  | 0 | 0.0 |
| Parent | Upset       | 0 | 0   | 54 | 94.7 | 0 | 0.0 | 0 | 0   | 107 | 94.7 | 0 | 0.0 |
|        | Guilty      | 0 | 0.0 | 52 | 91.2 | 0 | 0.0 | 2 | 1.8 | 102 | 90.3 | 0 | 0.0 |
|        | Work        | 1 | 1.8 | 56 | 98.2 | 0 | 0.0 | 2 | 1.8 | 111 | 98.2 | 0 | 0.0 |
|        | Financial   | 0 | 0   | 49 | 86.0 | 0 | 0.0 | 0 | 0   | 103 | 91.2 | 0 | 0.0 |

HE=Hardly Ever, O=Occasional, Oft=Often, VOft=Very Often, I DK= I Don't Know, N=Never

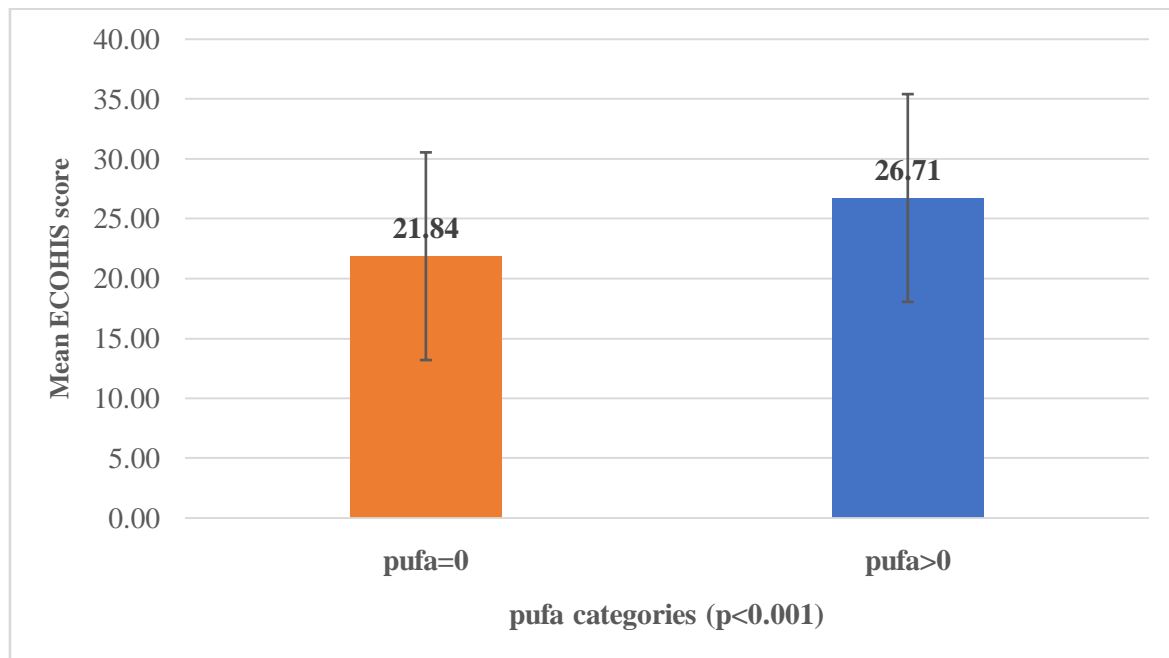
An overall pufa score ( $1.76 \pm 1.86$ ) and ECOHIS-A ( $25.08 \pm 8.46$ ) were found in this study. The mean pufa and ECOHIS scores varied across different nationalities and ages of the children. Non-Saudi's ( $2.55 \pm 1.47$ ) ( $32.64 \pm 11.2$ ) compared to the Saudi's ( $1.65 \pm 1.89$ ) ( $23.95 \pm 7.39$ ) showed significantly higher mean pufa score ( $p=0.005$ ) and ECOHIS scores than the ( $p<0.001$ ). Similarly, younger children aged four years ( $2.19 \pm 2.07$ ) demonstrated a significantly higher mean pufa score than the 5-year-old ( $1.16 \pm 1.29$ ) children ( $p=0.002$ ). However, the gender of children did not reveal any significant differences in mean pufa score and ECOHIS scores (Table 4).

**Table 4: Demographic variables of the children and pufa and ECOHIS scores**

| Variables   |           | pufa score |      |              | A-ECOHIS score |      |                  |
|-------------|-----------|------------|------|--------------|----------------|------|------------------|
|             |           | Mean       | SD   | p*           | Mean           | SD   | p*               |
| Nationality | Saudi     | 1.65       | 1.89 |              | 23.95          | 7.39 |                  |
|             | Non-Saudi | 2.55       | 1.47 | <b>0.005</b> | 32.64          | 11.2 | <b>&lt;0.001</b> |
| Gender      | Male      | 1.83       | 1.8  | 0.370        | 24.89          | 8.84 | 0.518            |
|             | Female    | 1.7        | 1.92 |              | 25.25          | 8.13 |                  |
| Age         | 4 Year    | 2.19       | 2.07 | <b>0.002</b> | 25.33          | 9.39 |                  |
|             | 5 Year    | 1.16       | 1.29 |              | 24.71          | 6.96 | 0.932            |

\* Mann-Whitney U test

The presence of untreated dental caries indicated by pufa>0 has shown a mean ECOHIS score of 26.71, and pufa=0 has shown a mean ECOHIS score of 21.84. When the mean ECOHIS scores were compared between pufa=0 and pufa>0, a statistically significant difference was observed ( $p<0.001$ ) as shown in (Fig 1).



**Figure 1: Relation between pufa categories and mean ECOHIS score**

Spearman's correlation test between mean ECOHIS score and pufa score showed a significant positive correlation ( $r=0.343$ ,  $p<0.001$ ) (Table 5).

**Table 5: Correlation between ECOHIS scores with pufa**

|                |              |                         | ECOHIS | pufa Score |
|----------------|--------------|-------------------------|--------|------------|
| Spearman's rho | ECOHIS score | Correlation Coefficient | 1.000  | .343**     |
|                |              | Sig. (2-tailed)         | .      | <0.001     |
|                |              | N                       | 170    | 170        |
|                | pufa score   | Correlation Coefficient | .343** | 1.000      |
|                |              | Sig. (2-tailed)         | .000   | .          |
|                |              | N                       | 170    | 170        |

\*\* . Correlation is significant at the 0.01 level (2-tailed).

#### IV. Discussion

This paper presents the results of a cross-sectional analysis that measured OHRQoL in 4-5 years children with untreated dental caries in dental clinics of a private university. In the current research, the initial version of the validated instrument of ECOHIS was used to measure OHRQoL in children [12].

In our study, children's father/mother/caregiver participated and self-administered the Arabic version of the ECOHIS-A questionnaire in the dental clinics' waiting area. A similar method was employed to collect the information in an original study by [12] in the USA. On the contrary, face-to-face interview with the primary caregivers was conducted to obtain ECOHIS information in various studies [17,18]. A self-administered ECOHIS-A was preferred in this study, as all the parents/caregivers were literate and able to understand the questionnaire items.

In this study, early childhood carious lesions were measured using the pufa index. This index provides data on the prevalence and severity of the pulpo-periapical disease resulting from untreated dental caries [14]. The pufa index is considered complementary to the dmft index as it provides appropriate information about untreated caries, its severity, and related quality of life impacts on children and parents [14].

In our study, it was found that, in the child impact section, the most common impacts were related to the children's self-image/social interaction, while symptoms and function were less affected. This finding contradicts the previous studies in which the most prevalent impacts were related to children's symptoms and functions [12,18]. However, all the items were high on the family impact scale. Thus, it can be observed that the oral conditions affected the child and impacted the family [18]. In this study, Do not know responses were recorded as missing responses during the analysis; hence the responses were not considered [19].

Non-Saudi children showed significantly higher pufa scores and, accordingly, higher ECOHIS scores. This finding could be explained by the fact that Saudi children could have easy access to dental care and government-sponsored programs. On the contrary, non-Saudi's exclusively depend on medical insurance for accessing dental care. Moreover, lack of insurance and expired insurance of non-Saudi children could have affected dental care resulting in higher untreated dental caries among non-Saudi children. Hence non-Saudi children likely to suffer from poor OHRQoL, as witnessed by increased ECOHIS-A scores than Saudi children. Moreover, age differences in pufa scores have been found since younger children aged four years had significantly higher pufa scores than the five years old.

Another interesting finding is the significant positive correlation between the mean score of untreated dental caries and the mean ECOHIS-A score. As the pufa score increased, the ECOHIS-A score increased, suggesting a decrease in the children's OHRQoL. It indicates the significant relationship between the pufa score and the OHRQoL of the children. This finding is similar to that reported by Saran et al. in 2019 [18].

One of our study's hypotheses was that children with a pufa score greater than zero would have poorer OHRQoL than children with a pufa score of zero. When opposed to children with a pufa score of zero, children with a pufa score greater than zero showed a more significant detrimental effect on all the scale parts. It has been reported that children with higher dmft scores demonstrated poorer OHRQoL [12]. In this study, the severity of the early childhood caries was evaluated by applying the pufa index that measured the consequences of the pulpo-periapical extension of caries among children's quality of life.

Since this study's data was collected from a convenience sample obtained from the single private university dental clinics, our findings are limited to this group of child patients. As a consequence, it cannot be applied to the general public at the community level. Further analysis in various locations and with different patient groups is needed to validate and affirm the extent of the results reported in this paper. Furthermore, having children who did not have early childhood caries may have allowed for a more in-depth contrast.

## V. Conclusion

Within the study's limitations, it can be concluded that untreated early childhood caries with pulpo-periapical extension negatively affected the quality of life of 4-5 years children and their families. The children's nationality and age had a significant effect on pufa score and, consequently, the children's quality of life.

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